

Amendments to the Drawings

Attached are replacement drawing sheets for amended
Figures 21-23.

REMARKS

Enclosed herewith for the Examiner's approval are replacement drawings for Figures 21-23 in which they are indicated as being "prior art". No new matter has been added.

The abstract and the specification have been amended in order to correct grammatical and idiomatic errors contained therein. No new matter has been added.

In order to respond to the Examiner's rejection of the claims under 35 USC 112, first and second paragraphs, and to more particularly point out and distinctly claim the subject matter which Applicants regard as the invention, Claims 1-3 and 10 have been canceled and replaced by newly presented Claims 17 and 18. No new matter has been added. Claims 4-9 and 11-16 have been amended in order to reflect the addition of newly presented Claims 17 and 18 and correct possible formal defects contained therein. No new matter has been added.

Claims 1 and 3-14 have been rejected under 35 USC 102(b) as being anticipated by Arnaud. Claims 1 and 3-14 have been rejected under 35 USC 102(b) as being anticipated by Lecoffre et al. Claims 2, 15 and 16 have been rejected under 35 USC 103(a) as being obvious over Arnaud or Lecoffre et al. Applicants respectfully submit that the currently claimed invention is patentably distinguishable over the prior art cited by the Examiner.

Applicants' invention, a defined by independent Claim 17, is directed to a cyclone separator for separating a fine substance from a liquid containing the fine substance. The cyclone separator comprises an introduction passageway for introducing the liquid containing the fine substance, a liquid pressurizing chamber containing an orifice ring for receiving the liquid containing the fine substance from the introduction passageway and discharging the liquid containing the fine substance through discharge passageways provided in the orifice rings at plural sites thereof in an eddy flow, the

orifice ring comprising an inner ring having an outlet liquid discharge passageway and an outer ring having an inlet liquid passageway, with the area of the inlet liquid passageway being varied through relative sliding movement between the inner ring and the outer ring in a circumferential direction, a cyclone body for receiving the liquid containing the fine substance in an eddy flow, separating the fine substance from the liquid containing the fine substance by transferring the fine substance to an outer circumferential side thereof by centrifugal force, discharging the liquid separated from the fine substance and precipitating the separated fine substance, and a liquid flow-out passageway for receiving the separated liquid discharged from the cyclone body and discharging the separated liquid from the cyclone separator. In another embodiment of the present invention, the cyclone separator comprises a plurality of cyclone bodies having a respective orifice ring associated with the respective cyclone body.

As discussed in the present specification, the cyclone separator of the present invention overcomes prior art problems by providing a cyclone separator that is capable of ensuring the required flow rate with a small sized system, improve the separation accuracy by separating particles into particles having accurate particle diameters and permit the flow rate and particle diameter of the separated particles to be varied by a simple method. In order to achieve these advantages, the present invention provides an orifice ring for receiving the liquid containing the fine substance from the introduction passageway and discharging the liquid containing the fine substance through discharge passageways provided in the orifice ring and plural sites thereof in an eddy flow. The orifice ring comprises an inner ring having an outlet liquid discharge passageway and an outer ring having an inlet liquid passageway, with the area of the inlet liquid passageway being varied through relative sliding movement between the inner ring and the outer ring in a circumferential direction. It is respectfully submitted that the prior art

cited by the Examiner does not disclose the presently claimed invention.

The Arnaud reference discloses an apparatus for separating suspended solid particles from fluids, for separating and mixing fluids and for dissolving gases in aqueous fluids. The apparatus comprises a grooved ring to define the fluid stream and impart a high velocity on each of the divided or sub-streams. The grooved ring can have any number of grooves that are spiral shaped and is used to create a high velocity circular motion on a divided stream for separation of suspended solid particles by centrifugal force in a cyclone filter. However, this grooved ring does not comprise an inner ring and an outer ring which are slidably movable relative to each other in a circumferential direction to vary the area of a liquid inlet passageway. By varying the area of the liquid inlet passageway, the size of the particles separated and the flow rate in the cyclone separator can be easily controlled. Since the Arnaud reference does not disclose this feature, it is respectfully submitted that the presently claimed invention is patentably distinguishable thereover.

The Lecoffre et al reference discloses a device for separating the constituents of a heterogeneous mixture. The device contains a separating chamber having at one of its ends an inlet and at the other end an outlet comprising a first ring-shaped orifice coaxial with the chamber and a second ring-shaped orifice coaxial with the first ring-shaped orifice and having an external diameter smaller than that of the first ring-shaped orifice internal diameter. However, like the previously discussed reference, this reference does not disclose an orifice ring made up of an inner ring having a liquid outlet discharge passageway and an outer ring having an inlet liquid passageway, with the area of the inlet liquid passageway being varied through relative sliding movement between the inner ring and the outer ring in a circumferential direction. Therefore, given the advantages of the presently

claimed invention discussed above, it is respectfully submitted that Lecoffre et al does not even present a showing of prima facie obviousness under 35 USC 103(a) of the presently claimed invention.

With respect to the combination of Lecoffre et al and Arnaud under 35 USC 103(a) rejection, since neither reference discloses an orifice ring as required by the currently presented claims, the references in combination do not make obvious the construction of the cyclone separator according to the present invention, either singularly or in combination. As stated above, Applicants have devised a unique orifice ring configuration which is neither shown nor suggested by the references cited by the Examiner. As such, the presently claimed invention clearly is patentably distinguishable over the combination of the references.

Reconsideration of the present application and the passing of it to issue is respectfully solicited.

Respectfully submitted,



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Encl: Replacement Drawings for Figs. 21-23 (3 sheets)
Replacement Abstract
Clean Substitute Specification
Marked-Up Substitute Specification
Postal Card

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